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AN ILLUSTRATION OF PRACTICAL RESULTS FROM THE PROTECTION OF NATURAL RESORUCES

ABOUT fifteen years ago a highly enlightened administration of the government of Peru became interested in the decline of the country's valuable guano industry and the apparent diminution in number of guano-producing birds. It was the privilege of the writer to be engaged by the Peruvian government for an investigation of the condition of the guano industry and the possibilities of its preservation, as well as for studies relating to the fisheries and to the marine fauna and flora. On my arrival in Lima I was impressed with the alert attitude of government officials in reference to the guano industry and with their anxiety to take whatever measures might, as the result of careful investigation, be found conducive to the conservation of the guano birds. A most significant preliminary step had indeed already been taken through the closure of the three Chincha Islands.[1] After an extended investigation, a series of recommendations for the general regulation of the guano industry was submitted to the Director de Fomento, and, with his approval, the report was reproduced in SCIENCE for July 10, 1908. A few excerpts from that report will be illustrative.

2. The present tendency to decrease in numbers (of birds) may be checked. There is a wealth of reliable testimony from the older men of long experience in the industry, that the useful birds, . . . were formerly vastly more abundant than now. . . . If they have endured the treatment they have received without decrease in numbers, then pro-

[1] Two of the islands were shortly opened for guano extraction under pressure of circumstances, but the South Island remained closed through three breeding seasons, affording a convincing demonstration of the utility of the measure. (See "Habits and Economic Relations of the Guano Birds of Peru," *Proc. U. S. N. M.*, Vol. 56, p. 484.)

tection can hardly be worth while. On the other hand, if it is true, as represented by every one who should know, that there has been a great diminution in number of birds, then—

3. *We may hope that the protection of the birds will result in a great increase in their numbers.* Before the working for guano on a large scale began and before the nesting grounds began to be plundered for eggs and fowls, the birds must have existed in a condition of abundance dependent upon their food supply, their enemies and their natural prolificness. New factors have entered in recent years which have caused the birds to decrease materially below this *normal condition of abundance.* If these unfavorable factors are removed by well-considered and well-executed protective measures, why may we not see an increase in number toward the former normal abundance?

I think it conservative to say that the proper protection of the birds means the saving to Peru of hundreds of thousands of dollars' worth of guano each year. . . .

We . . . may well plan for protective measures that are intended to work progressively to the advantage of the industry for the next twenty years or more. We want to see many more birds in 1915 than are present in 1908, and more birds in 1920 than in 1915; and this will not be accomplished by routing the birds from their nesting grounds as soon as they are fairly established.

The general plan of protection comprised the following essential elements.

1. The admission of but a single concessionist to an island or a group of islands in order to eliminate the vigorous competition which was resulting in utter disregard of the needs of the birds, requiring also that the concessionist, through a resident representative on each island, should be held responsible for the fullest protection of the birds.

2. The closing of islands for periods of years.

3. The continuation of the existing yearly closed season of months.

4. Placing the extraction of guano for national agriculture in the hands of a single company, which would thus "be induced to plan for the future."

5. Adjustment with the Peruvian Corporation, Limited, whereby detrimental competition between the exporting corporation (to which a considerable portion of the guano was mortgaged) and the national company might be obviated.

The problem before the government, the national agriculture, and the exporting company, is this: How can the guano industry be saved to the future? Certainly no legitimate interest can be furthered by a continuance of the present unsatisfactory system, with its sacrifice of the birds.

I think the solution of the problem will be furthered if we put the question in this way: What system of regulation will result in the greatest annual deposit of guano twenty years hence?

It was a comparatively easy matter to offer recommendations, but an extremely difficult one to give them effect, because of complications arising from the heavily mortgaged condition of the guano deposits, the inadequacy of the current deposits for the use of national agriculture, and the restive internal conditions which culminated, shortly after the recommendations were presented, in the most serious revolutionary movements known in many years. The matter of the preservation of the guano industry was not, however, lost track of, altogether, and it is understood that several of the measures proposed were given effect at an early date. A later government took up the matter again in a serious way and enlisted the services of Professor S. O. Forbes of England who made a careful study of the conditions and submitted a comprehensive report to the Peruvian government. As this report has not been published it can not, unfortunately, be cited in this connection. It is evident that the protective measures now in effect are based upon the essential principles outlined above. The extraction of guano for national agriculture was placed in the hands of a single organization, the Compañia Administradora del Guano, directly responsible to and regulated by the government. Suitable adjustments were made with the Peruvian Corporation Ltd. The closed season was continued, and the closing of islands for periods of years became an established part of the plan of regulation. Guardians were put upon the several islands.

As to the results, we have convincing testimony from Dr. Robert Cushman Murphy, of the Brooklyn Institute of Arts and Sciences, who has recently visited Peru and given especial attention to the birds of the guano islands. Some of his observations are comprised in a series of papers of fascinating interest entitled "The Sea Coast and Islands of Peru" appearing in current numbers of the *Brooklyn Museum Quarterly*. I quote from the last number (October, 1920, p. 250).

The first undertaking of the Compañia Administradora del Guano under the able directorship of Senor Francisco Ballen, was to make each of the numerous guano islands a bird sanctuary, closed at all seasons of the year to unauthorized visitors. Competent guardians with duties scarcely less exacting than those of lighthouse keepers, were posted as permanent residents upon every group. Clandestine guano extraction, the stealing of birds' eggs for food or for the use of the albumin in clearing wine, and other disturbances which had formerly caused havoc in the colonies, ceased at once. The old method of extracting guano without regard to the presence or physiological condition of the birds has, of course, been abolished, the islands, under the new rule, being worked according to a system of rotation which leaves ample and congenial breeding grounds always available. Courting or nesting birds are now carefully shielded from disturbance. Moreover, after removal of the guano, an island is promptly vacated and is thereafter given over to the complete possession of the birds for a period of approximately thirty months, at the expiration of which the date for a renewal of digging operations is determined only after careful reconnaissance.

The régime of the Compañia Administradora del Guano, with its well-balanced regard for both business and conservation, has resulted in a nearly uniform increase in the annual increment of guano, as well as a promising outlook for a continually augmenting supply while the birds are repopulating the breeding grounds to the limits imposed by space and the nutritive resources of the littoral ocean. Since 1910, the administration has issued an annual "Memoria" containing statistical data, from which the following table of production has been taken:

Seasons	Guano Production
1909–1910	25,370 tons
1910–1911	24,921 "
1911–1912	18,636 "
1912–1913	24,350 "
1913–1914	31,486 "
1914–1915	24,446 "
1915–1916	43,721 "
1916–1917	59,208 "
1917–1918	87,898 "
1918–1919	80,517 "

The slight fluctuations in the column are doubtless due to the fact that no island is worked two years in succession, which results in a somewhat disproportionately large yield for the seasons in which the product of the most important islands is included. In a letter dated August 24, 1920, Senor Ballen writes that the guano output for the current year will exceed 82,000 tons, of which 70,000 tons will be required by native agriculturists and 12,000 tons will be at the disposal of the Peruvian Corporation for export. It should be understood that the tabulated figures refer to newly deposited guano, for the so-called "fossil" beds have been long since exhausted except upon Lobos de Tierra and Lobos de Afuera.

Most instructive deductions may be made from the table of guano production just quoted. In the first place, it is evident that in the early years of the period covered the annual production of guano was approximately as estimated in 1908, *i.e.*, from 20 to 25,000 tons per annum. In the second place, it appears that, beginning about 1913, the annual production of guano (proportioned in large measure to the abundance of producing birds) has risen to more than 80,000 tons at the present time. The production now is approximately three times as much as it was ten years ago. In 1908 the annual deposits were far below the estimated requirements of national agriculture, disregarding the export requirement. In 1920 the production substantially exceeds a greatly increased requirement for national agriculture so that a moderate export may be carried on even without sacrifice of internal requirements. The government derives revenue of more than a million dollars a year from the extraction of guano, a reasonable profit accures to the Compañia Administradora, and presumably to the export

corporation, while Peruvian planters obtain the most valuable fertilizer at a price which our American farmers would consider astonishingly low.

Now, in the words of Captain Cuttle, "The bearings of this observation lays in the application on it."

In the first place, one of the essential principles upon which this scheme of protection is founded is that of closure of breeding grounds in rotation *for periods of years.* This principle must be distinguished from the common measures of protection through closed seasons or the establishment of permanent sanctuaries. While the latter is in many cases an ideal method of protecting animals, it is of course impracticable of application in the case of guano birds and many objects of chase or fishery.

Closed seasons of a few months produce good results in many cases, but such a principle of protection has the defect (often unappreciated) of being based upon an assumption that nothing essential to reproduction takes place except when the reproductive activities are externally evident. It seems sometimes to be assumed that destruction or disturbance of an animal *before* it spawns makes no difference. The closed season of months has, to be sure, its proper place, and is often the only feasible measure.

The second application is that the plan of temporary sanctuaries, as applied to guano-producing birds, has evidently worked and produced the desired results in high degree. The annual production has been *trebled* in ten years. Why then can not the plan be more generally applied in the case of natural objects requiring protection? It seems to be based upon a proper appreciation of physiological, "social" and ecological conditions as affecting successful reproduction. This is the principle, by the way, which for eight years has been advocated for the preservation of the fresh-water mussel resources of our interior streams, but which is as yet being given effect in a small way in only two states.

A final application to be made in this connection is not the least in importance. The enforcement of any broad and effective plan of protection of guano birds was confronted ten or twelve years ago with obstacles which one might fairly have considered insurmountable: foreign obligations with their customary difficulties of adjustment; national agricultural demands so exceeding the yearly production as to make temporary curtailment most aggravating to Peruvian agriculturists; restive political conditions such as usually demand the service of the present rather than of the future. How do such difficulties compare with those which confront the protection of fresh-water mussels or the development of the oyster industry in the Chesapeake Bay, for example? Surely, as Dr. Murphy has appropriately suggested, credit is due primarily to the patriotic and far-sighted citizens of Peru who accepted the preliminary sacrifices and *did what was evidently needed to be done.*

When we consider that the conservation measures cited were so promptly and fruitfully executed in one of our sister republics south of the equator it ought to "give us pause"—or else it should stimulate us to stop pausing and proceed to take like care of some of our own natural resources.

R. E. COKER

BUREAU OF FISHERIES

NATIONAL TEMPERAMENT IN SCIENTIFIC INVESTIGATIONS

WE have too long adjusted our scientific thought to the temperature of a European atmosphere. It should not be necessary to guard the voice of our scientists against the unnatural accent of the parrot. What was true of literature when Emerson read before the Phi Beta Kappa Society at Cambridge his celebrated oration on "The American Scholar" is now true of scientific investigation in the United States. "We have listened too long to the courtly muses of Europe." We have too much taken our problems from European investigators and have too little allowed nature to ask her own questions of us. These problems we have treated too much in the spirit of European (and

especially of German) investigation. Too little have we allowed rein to our own individuality in the choice of subject and the development of method.

Let it be granted that the people of Europe have attacked the problems and developed the methods best suited to their needs and their temperament. This seems to be true. The several important groups, following their own native inclinations, have marvelously succeeded in organizing nature in useful ways and have made conquests of the forces of the environment never approached by any other peoples. They have acted upon the realization that the best truth which any mind or any nation can create or discover is that which comes to it in the course of spontaneous activity. When we so proceed that our thinking is a natural expression of our native bent our discoveries will become typical of ourselves and we shall render into the whole worth of mankind a good which we can not attain by following the lead of another people. "He is great who is what he is from nature and who never reminds us of others."

Let us not run after the ways of another people. Let us also not run from the ways of another people. Let us follow our own ideals; let us develop our own spirit in the search for truth; let us be just to our own temperament. Our civilization is based on our European origin. We can not escape that fact. There is no need to try to run away from the nature which we have inherited. But there is a fundamental necessity that our thought shall not try to follow in the way pointed out by European thinkers of to-day; just as it is important that Europe shall continue to think in her own way and not seek to be guided by us.

We are a combination of social units which have not existed together before and are not now to be found together elsewhere. In some measure and in some phases we have developed our own national intellectual spirit; the present progress in American poetry, for instance, is not inspired by European models but is a native product arising from the basic foundation inherited from our European ancestry. But in scientific matters we still have a great tendency to attack problems set by European investigation rather than to follow our own more spontaneous activity and so find that truth which our temperament makes it possible for us to discover more easily than any other people.

Our attitude in this respect is strongly contrasted with that of the great nations of Europe. They have proceeded in ways of their own. Though science is cosmopolitan the scientific work of the greater groups in Europe is national in spirit. Notwithstanding the close interactions of the modern world and the systematic exchange of scientific knowledge, national traits find spontaneous expression in the researches of different countries.

British science is characterized by the spontaneity and individuality of the workers, with consequent large power in fundamental conceptions, so that a greater measure of dominant ideas in the science of to-day goes back to them perhaps than to those of any other people. They do not congregate in distinct schools and institutions. They are not localized in definite centers. No army of well-trained intellectual workers exists among them. No compact body of pupils there develops the work and ideas of any master. The self-reliant strength of natural genius dominates the scientific spirit. The British have produced a disproportionate number of new ideas and great departures. They have no university eager to nurse and develop new talent, so that the new thinker becomes devoted to nature. He lives close to the heart of things and nature rewards his independence of other thinkers.

German science is remarkable for the organization of the investigators and the resulting wealth of detail in developing the consequences of fundamental ideas once introduced and in preparing indexes and summaries of the current literature of discovery. The universities of Germany form the most characteristic institution of the German mind and afford the most perfect expression of its essential character, especially as regards sci-

entific work. These universities form one of the greatest intellectual agencies of the modern world. Among them arose the now universal habit of looking upon private study and research as a necessary qualification of the teacher. They teach not only knowledge but also research. To them largely is due the fact that German investigators stand under the generalship of a few great leading minds. They, more than any other single force, should be credited with the fact that so many persons in Germany are devoted to the pure ideal of knowledge for its own sake.

It is true that this ideal had been somewhat dimmed, even before the Great War, by the incessant demands of utilitarian motives; but it is to be hoped that it will again come into the ascendency and once more renew faith in the importance of the more ideal values.

There is danger that the ideal of knowledge for its own sake may dull the sense of values and lead one to a practise of treating trivial things with the same care as the matters of great moment. Indeed it seems that the Germany of the past has suffered in this respect.

> In no country has so much time and power been frittered away in following phantoms, and in systematizing empty notions, as in the Land of the Idea.

Emerson somewhere employs a beautiful fable of antiquity, pregnant with rich truth, that "the Gods in the beginning divided Man into men that he might be more helpful to himself, just as the hand was divided into fingers the better to answer its end." In our day Man has been broken into smaller pieces than ever before to make the men of the generation, a process which has been carried further in Germany perhaps than anywhere else. We have specialists instead of Man specializing. We have scientists instead of Man investigating nature. We go much further than that; we have the geologist, the biologist, the entomologist instead of Man intensely studying earth formations, living things, insects. Instead of having the mere specialist of a particular sort we should have Man investigating nature, having special tools to be sure and confining attention to a particular range of subject matter not too vast for him, but preeminently Man. The individual, in order to possess himself and to orient his work in the general activity of mankind, "must sometimes return from his own labor to embrace all other laborers." Man should not be so minutely divided and peddled out as to be spilled into drops that can not be gathered up again.

The more universal is the character of the national temperament the more difficult it is to single out its peculiar traits. Striking characteristics are more readily recognized than highly developed features of central importance. Whether from this fact or from some other it is not so easy to determine the characteristics of French thought as of British or German, when one confines his attention to the present generation of thinkers. But if one looks into the history of the past century he will have no occasion of doubt as to the way in which the scientific spirit has manifested itself in France. Its flower can be easily recognized to-day in the elegance and finish, sense of proportion and importance, careful emphasis of the greater matters, which are characteristic of the work of the French. Intimately connected with this and interacting with it to the advantage of both is the fact that France has done more than other countries to popularize science—a thing which must be recognized as affording a very valuable and powerful stimulus to the growth of the scientific spirit.

In the first decades of the last century the home of the scientific spirit was in France. Paris was the capital of the republic of exact truth. Interest in scientific discovery and creation was widespread among her people. The spirit of literature flourished alongside the spirit of exact researches and both found place in the same creative intellect. Out of this union of elements, too much separated in other countries, there grew up a tradition of literary excellence in scientific exposition which abides to the present and contributes in no small way to the comfort and delight which

every one must feel in reading a French scientific book or memoir.

The profound use of analytical methods and the reduction of scientific truth to rigorous yet pleasing mathematical form is characteristic of the French. The mechanical view of nature arose among them. They were the first to set out to see how far science and reasoning can go while disregarding the principle of individuality. Among them science first became "truly conscious of its true methods, its usefulness, its most becoming style, its inherent dignity, its past errors, its present triumphs, the endless career which lies before it, and the limits which it can not transgress."

Of the three countries which have led in scientific development it seems to be the impartial verdict of history that we owe to France the largest number of works perfect in form and substance and classical for all time; that the greatest bulk of scientific work, at least in more recent decades, has been produced in Germany; but that the new ideas which have fructified science, in earlier times and also in the nineteenth century, have arisen more frequently in Great Britain than in any other country.

Science is cosmopolitan and flourishes under many skies. But the spirit of scientific work is national. Each great people manifest their own characteristics. They develop truth by methods influenced by the peculiar bias native to their temperament and institutions. No prime contributions to knowledge have ever been made repeatedly through a long period of time by any people other than those who labored from a center situated at the heart of their life and social organization. The deep-lying unknown things in nature can be found out only by one who looks upon her with eyes of his own. A people who seek guidance outside of themselves will never be led in the paths of high achievement. Only during their minority can they afford to lean upon the strength of others more powerful than they. On coming of age it is indispensable that they shall work from a center of their own.

American science should now begin to render to the science of other countries a measure of support commensurate with that which it receives in turn in the mutual cooperation of all in the discovery of truth.

Up to the present we in America have not developed either a national spirit or a national tradition in scientific investigation. Research was not native to our soil and was not introduced by the first settlers. Along with the other portions of our European civilization our scientific attitude has come to us by inheritance. But we have now come to the time when American scientists may begin to proceed from an intellectual center of their own and make contributions in a characteristic spirit to the intellectual worth of mankind.

R. D. CARMICHAEL

UNIVERSITY OF ILLINOIS

SCIENTIFIC EVENTS

THE PROPOSED NEW CHALLENGER EXPEDITION

Nature announces that the council of the British Association has reluctantly decided that the organization of a new *Challenger* expedition, such as was suggested by Professor W. A. Herdman in his presidential address to the association at Cardiff last August, on an adequate scale can not be profitably promoted at the present time.

In accordance with the resolution passed by the general committee at the Cardiff meeting, the council appointed a special oceanographic committee to inquire into the details of the suggested project and to prepare a reasoned statement as to the need for such an expedition and its probable scale, scope, equipment, and cost. This memorandum has now been completed, and is available for use when the occasion arises; but in view of the present demand for economy in all national expenditure, and after consultation with trustworthy authorities, both scientific and administrative, the council at a recent meeting adopted a report by the general officers to the effect that, while retaining the scheme under consideration, no further action should be taken until circumstances seem more favorable for public expenditure upon such an undertaking.

The oceanographic committee will remain in existence with a watching and organizing brief ready to revive the project whenever a favorable opportunity arises, and the council will doubtless report upon the whole matter to the meeting of the general committee of the association at Edinburgh next September. It is hoped that the proposed expedition is postponed only for a season, and that the interval may be usefully employed in perfecting plans and making other essential preparations.

THE NOLAN PATENT OFFICE BILL

The American Engineering Council of the Federated American Engineering Societies will seek at the opening of the special session of Congress to have the Nolan Patent Office Bill passed.

Failure of the measure in the last session is attributed to the presence of the Federal Trade Commission section which Edwin J. Prindle, of New York, chairman of the American Engineering Council's Patents Committee in a report to L. W. Wallace, executive secretary of the council, asserts should not be enacted into law in any form even as a separate bill. The committee reports:

The bill for the imperatively necessary relief of the Patent Office, after passing the House of Representatives with satisfactory provisions for the Patent Office, failed to pass the Senate at the session just closed with those same provisions, solely because of the presence in it of an unrelated section known as the Federal Trade Commission Section.

The former opposition in the Senate to the Patent Office relief and that which forced the unacceptable reductions in salaries and numbers of examiners and clerks (which the Conference Committee was persuaded to set aside) is largely and seemingly almost wholly overcome. But the opposition in the Senate to the Federal Trade Section is determined and has expressed an intention to prevent the Patent Office from getting the desired relief unless the Federal Trade Section is removed from the bill.

More than preventing the Patent Office relief, however, the Federal Trade Section is believed to be a dangerous measure in itself. It provides that the Federal Trade Commission may receive assignments of and administer inventions and patents from governmental employees and is an entering wedge for further legislation to empower the Trade Commission to receive patents from non-governmental inventors or owners.

An exclusive license would have to be granted, at least for a few years, to induce any one to undertake the almost always necessary development expense, and the Trade Commission would surely be charged with favoritism in granting such a license. In order to protect its licensees, the Trade Commission would have to sue infringers, a most unfortunate activity for the government. The industries would close their doors to the government employees fearing to disclose to them their secrets or unpatented inventions, and research by the industries would be discouraged for fear that government employees, using government facilities, might reach the result first and patent it.

THE AMERICAN PHILOSOPHICAL SOCIETY

The American Philosophical Society will hold its general meeting in the hall of the society on Independence Square on April 21, 22 and 23. The program includes the following discussions:

The Application of the Method of the Interferometer to certain Astronomical Researches:

To astrophysical problems: Henry Norris Russell, Ph.D., professor of astronomy, Princeton University.

To the measurement of double stars: Frank Schlesinger, Ph.D., director, Yale University Observatory.

To the determination of stellar parallaxes: John A. Miller, Ph.D., director, Sproul Observatory, Swarthmore, Pa.

Atomic structure:

David Webster, professor of physics, Leland Stanford University.

William Duane, director of radium institute, Harvard Medical School, Boston.

Bergen Davis, professor of physics, Columbia University.

On Friday evening there will be a reception in the hall of the Historical Society of Pennsylvania, when Dr. James H. Breasted, professor of Egyptology and Oriental history, University of Chicago, will speak on "Following the trail of our earliest ancestors" illustrated by lantern slides.

Award will be made of the society's Henry M. Phillips Prize of two thousand dollars for

the best essay on, "The control of the foreign relations of the United States: the relative rights, duties and responsibilities of the President, the Senate and the House, and of the judiciary, in theory and practise," and presentation of John Scott Medals "For Useful Inventions," by Owen Roberts, Esq., on behalf of the Board of City Trusts of Philadelphia.

SCIENTIFIC NOTES AND NEWS

THE National Institute of Social Sciences has awarded its gold medal to Mme. Curie.

MR. HERBERT C. HOOVER has been elected a trustee of the Carnegie Institution of Washington.

PROFESSOR A. S. EDDINGTON has been elected president of the Royal Astronomical Society in succession to Professor A. Fowler.

MR. C. TATE REGAN has been appointed keeper of zoology at the British Natural History Museum, South Kensington.

DR. JOHAN HJORT, director of the Norwegian Fisheries, has received the degree of doctor of science from the University of Cambridge.

WE learn from *Nature* that the following were elected fellows of the Royal Society of Edinburgh at the ordinary meeting on March 7: Dr. Nelson Annandale, Mr. W. Arthur, Mr. B. B. Baker, Dr. Archibald Barr, Mr. J. Bartholomew, Mr. A. Bruce, Mr. Andrew Campbell, Dr. Rasik Lal Datta, Dr. John Dougall, Dr. C. V. Drysdale, Mr. G. T. Forrest, Dr. W. Gibson, Dr. J. W. H. Harrison, Mr. J. A. G. Lamb, the Rev. A. E. Laurie, Mr. Neil M'Arthur, Mr. D. B. M'Quistan, Dr. T. M. MacRobert, Dr. J. M'Whan, Mr. J. Mathieson, Sir G. H. Pollard, Professor E. B. Ross, the Right Hon. J. P. Smith, Professor N. K. Smith, and Dr. I. S. Stewart.

AT the Chicago meeting of the American Association for the Advancement of Science, the council established a committee on conservation to cooperate with similar committees of other organizations. This new committee on conservation has now been appointed, its personnel being as follows: J. C. Merriam, *chairman,* Carnegie Institution of Washington, Washington, D. C.; Isaiah Bowman, American Geographical Society, New York City; H. S. Graves, 1731 H Street, N.W., Washington, D. C.; Barrington Moore, 925 Park Avenue, New York City; V. E. Shelford, University of Illinois, Urbana, Ill.

DR. HAVEN EMERSON, formerly commissioner of health of New York City, has been appointed medical adviser and assistant director of the Bureau of War Risk Insurance.

DR. P. G. NUTTING, organizer and for the past four years director of the scientific research of the Westinghouse Electric Company, will not be with that company after May 1. Dr. Nutting was for ten years with the Bureau of Standards, leaving in 1912 to assist Dr. Mees in the organization and development of the research work of the Eastman Kodak Company.

DR. L. A. MIKESKA has resigned from the Color Laboratory of the Bureau of Chemistry, U. S. Department of Agriculture, to join the staff of the Rockefeller Institute for Medical Research, New York City.

DR. HENRY E. CRAMPTON, of Barnard College and the American Museum of Natural History, has returned from a nine months' trip to the tropics and the islands in the Pacific.

JOHN W. GILMORE, professor of agronomy at the University of California, has been appointed exchange professor from the United States to the University of Chile for the academic year 1921–1922.

DR. LAFAYETTE B. MENDEL, professor of physiological chemistry, Yale University, spoke before 500 members of the Chicago Section of the American Chemical Society on Friday, March 18. Preceding the talk, a dinner in honor of Dr. Mendel was served at the Quadrangle Club, University of Chicago.

ON March 12, the Mayo Foundation, Rochester, Minn., was addressed by Dr. James Ewing, President George E. Vincent and Dr. Charles Choyce.

Professor Douglas Johnson, of Columbia University, addressed the annual open meeting of the Syracuse University chapter of Sigma Xi, March 16, on "The rôle of geography in world affairs." On March 17, he spoke at Colgate University on the same subject.

The Council of the Paris Faculty of Medicine, has received a gift of 50,000 francs from Mme. Mathias Duval, widow of the eminent professor of histology. The sum having been given without any conditions as to the manner in which it shall be expended, a committee has been appointed to decide how it can best be employed.

Plans to broaden the scope of the Gorgas Memorial Institute in Panama into a research and teaching institution of international scope are being developed by the provisional board of directors for the United States.

Ernest Joseph Lederle, the sanitary engineer, died on March 7, at the age of fifty-six years. Dr. Lederle was health commissioner of New York City under Mayor Low and Mayor Gaynor.

UNIVERSITY AND EDUCATIONAL NEWS

The latest report on the Worcester Polytechnic Institute Endowment Fund indicates pledges of over $900,000 to date. The committee in charge has no doubt that the entire $1,000,000 will be pledged before Commencement Day. This is the second million of the $2,000,000 fund undertaken, the first million having already been pledged, partly in the form of scholarship funds given by industrial corporations in Worcester.

An appropriation by the Oregon legislature of $271,000 has been made for medical work in Portland by the University of Oregon.

The corporation of Yale University has adopted regulations with reference to research associates and research fellows. Research associates are to have professorial rank, and research fellows assistant professorial rank. The titles are to be given to men of distinguished attainments who devote most of their time to research rather than to teaching. It was voted "That the title of research associate should be confined to men of real distinction in research and productive scholarship, and that it should carry with it inclusion in the list of 'Professors and other officers of professorial rank,' the object of the position being to attract to the university men of eminence, who usually wish greater freedom in the use of their time for research than professorial appointments permit."

Eugene E. Haskill, S.E., dean of the combined colleges of civil and mechanical engineering at Cornell University has resigned. His resignation is to take effect in June of this year after his sabbatic leave, which he is now enjoying. Dean Haskill has been at the head of the college of civil engineering at Cornell since 1905, prior to which he was in charge of the United States geodetic survey of the Great Lakes. Dean Haskill is a graduate of Cornell University, class of 1879; his successor, Professor F. A. Barnes, is also a Cornell graduate, having been granted his degree in 1897.

Dr. Paul Weatherwax, for the past two years associate professor of botany in the University of Georgia, has resigned to accept an associate professorship in Indiana University, where he was formerly instructor.

Professor Irving H. Cameron, for many years professor of surgery in the medical department of the University of Toronto, has relinquished that chair, and Dr. Alexander Primrose has been appointed to succeed him temporarily.

DISCUSSION AND CORRESPONDENCE

ARE THE LANCE AND FORT UNION FORMATIONS OF MESOZOIC TIME?[1]

To the Editor of Science: Under the above title Professor Charles Schuchert has recently reviewed in Science (issue of January 14) a

[1] Published with the permission of the director of the U. S. Geological Survey.

publication of the Geological Survey by Dr. T. W. Stanton on "The Fauna of the Cannonball Marine Member of the Lance Formation." Following the review Professor Schuchert announces his opinion that the evidence

> binds invertebrate paleontologists and geologists together in the conviction that the Lance and the Fort Union are of Mesozoic time. The U. S. Geological Survey should now reverse its former conclusion and adapt itself to the fuller evidence.

In the first conclusion Professor Schuchert adopts the view of Dr. Stanton and of Messrs. Lloyd and Hares, who described and named the Cannonball beds in 1915, as to the Lance formation, but goes even further than they do in assigning the Fort Union to the Mesozoic. However, it does seem difficult to justify a separation of these formations, making one Cretaceous and the other Eocene.

As a geologist long interested in the Cretaceous-Eocene problem of the Rocky Mountain region, I wish to comment that Professor Schuchert is not warranted in assuming to speak for geologists inasmuch as he does not regard much of the geological evidence. Nor does he give due weight to paleontological data, aside from those of the mollusca. Moreover, it seems gratuitous to assume that the Geological Survey, because it has not adopted the conclusion reached by Professor Schuchert, has not considered in its decisions the bearing of facts concerning the Lance secured by its own investigators some years ago. The Survey geologists have also secured much other evidence.

Now it is perfectly well known to Professor Schuchert that the question as to the age of the Lance and Fort Union beds is a part of a very large problem, involving a conception of the geologic evolution of the whole Rocky Mountain Province from Mexico to far north in Canada. More than a score of more or less local formations, younger than the great continuous Cretaceous section and older than the Wasatch Eocene, are to be correlated and interpreted. These formations present a great deal of varied evidence as to the history of the Cretaceous-Eocene transition period. The Survey has, in fact, based its action, with which Professor Schuchert disagrees, on a consideration of all available evidence.

Investigations of the Rocky Mountain Province and adjacent lower country to east and west, made within 30 years past, have surely proved that the older idea of the diastrophism which characterized the transition from the Cretaceous to the Eocene period was very faulty. The change was gradual, not abrupt, and, while over a large area the great Cretaceous succession was ended, the uplift was epeirogenic for a long period during which erosion and prevailingly continental deposition proceeded, and there was no such abrupt environmental change affecting life upon the land as has been assumed. In general the newer picture of Rocky Mountain development, after Laramie time, gives no basis for the belief that dinosaurs and some other dominantly Mesozoic land forms could not survive into the Eocene. In fact, dinosaurs of the type found in the Lance lived in the Denver epoch, that is, they survived during the period in which the entire Cretaceous section was removed from a large part of Colorado and adjacent regions.

The Lance and Fort Union formations of eastern Montana and adjacent portions of the Dakotas present an exceptionally interesting and important association of stratigraphic and paleontologic data, the subject of conflicting ideas which must eventually be harmonized. Their correct interpretation will contribute much to our understanding of Rocky Mountain history. The most striking data will be briefly specified.

The Lance in some places rests with erosional unconformity on the Fox Hills Cretaceous, the gap being of undemonstrated extent. It may be large, and not small, as Schuchert assumes. In some districts Lance and Fort Union form an apparently continuous section reaching 5,000 or more feet in thickness. In one limited area only, the Ludlow lignitic and Cannonball marine shale members are seen to separate the formations.

A well defined flora runs through both Lance and Fort Union. It is considered

clearly Eocene by Knowlton. This view was not seriously opposed until the flora, first found in the Fort Union, was traced down through the Lance almost to its base. The flora thereby lost much of its interest to vertebrate and invertebrate paleontologists, but not to paleobotanists or geologists.

The Fort Union beds have a mammalian fauna of small forms considered to prove the Eocene age of the strata containing them until allied types were found in the Lance associated with dinosaurs and other supposed Cretaceous forms. The significance of the poor little mammals has seemed to disappear, from certain standpoints, but not from all. The Ceratops fauna of the Lance is closely similar to that of the Denver beds, correlated by the Geological Survey, together with other Colorado and New Mexico formations, with the early Eocene beds of the Gulf region.

The Cannonball shales demonstrate the temporary return of marine waters from an unknown and as yet undiscussed region to the Dakota district, after an absence which was of considerable duration. Where was this sea meanwhile? The known Cannonball fauna consists of two sharks, several corals and foraminifera, all of which range into the Tertiary, and 60 molluscan species. The molluscan group, according to Stanton, has "the general aspect of a Tertiary fauna," but he considers 24 species to be identical with forms in the Fox Hills or Pierre formations of the Cretaceous nearby, while not one is identical with any known form in the lowest Eocene of the Gulf region and 35 are new species.

Dr. Stanton has given, in the excellent publication reviewed by Professor Schuchert, a careful description of the Cannonball fauna and discussed its relationships to Cretaceous and Gulf Eocene faunas. Elsewhere he has discussed the age of the Lance on general grounds but he has always given the greatest weight to the character of the invertebrate fauna, as is natural considering his special point of view.

Professor Schuchert has gained wide reputation for his broad studies in paleogeography. His mature opinion was no doubt expressed in his "Text-book of Geology," (1915, p. 581) where he says:

> It is, therefore, the principles of diastrophism and paleogeography that will eventually correctly define the periods or systems.

It may seem at first thought that this principle guided Professor Schuchert in his opinion that two paleogeographic maps presented by Stanton "are a most striking summation of the problem in hand . . . ." That judgment seems, to the writer, far from the truth.

One of these maps (after Schuchert) represents the Pierre Cretaceous ocean as extending from the Gulf of Mexico through the Rocky Mountain region far toward the Arctic, with a land barrier reaching from the east at least to the boundary of Colorado and New Mexico. This barrier may have extended further. The other map shows the supposed early Eocene limits of the Gulf sea and the geographic position of the Cannonball area. What is needed is a paleogeographic map, or several of them, to express a reasonable hypothesis of the course of retreat of the sea as the land barrier rose and apparently cut off entirely a restricted northern ocean from the Gulf sea, perhaps before Fox Hills time. Somewhere there was an open sea, insisted on by Dr. Stanton, cut off from the Atlantic-Gulf ocean, in which the Fox Hills fauna was modified to that found in the Cannonball.

Unfortunately Dr. Stanton does not discuss the origin, the position, the extent, or the climatic and other conditions of the open sea in which this modification took place. He considers that the Fox Hills is the approximate equivalent of the upper part of the *Exogyra costata* zone, which is near the upper limit of the Cretaceous in the Atlantic-Gulf region. He nevertheless recognizes "considerable differences" in the faunas, which he attributes to lithologic facies, geographic separation, and possibly to climate.

It seems to a geologist necessary for the

invertebrate paleontologist to give some attention to the possibility that a northern isolated sea existed into early Eocene time and that its conditions produced a modification of the Cretaceous molluscan fauna naturally different from that arising during the same time in the Gulf region. Does not the Cannonball fauna show what modification had been reached at a time which, under the existing conditions, must be placed in the general time scale by utilizing, instead of ignoring, the other facts of the Lance and Fort Union formations, and also the concordant knowledge of Rocky Mountain history?

WHITMAN CROSS

WASHINGTON, D. C.,

TO THE EDITOR OF SCIENCE: In SCIENCE for January 14, 1921, Professor Schuchert, in reviewing Dr. Stanton's recent paper on "The fauna of the Cannonball marine member of the Lance formation," proceeds to answer this query in a most emphatic and unreserved affirmative. He assumes to speak with authority for geologists and vertebrate and invertebrate paleontologists, but he admits that the "floral brethren" will, of course, continue to dissent. The problem of establishing the line between Cretaceous and Tertiary time in the Rocky Mountain province has been more or less of a storm center for a number of years, but the question can only be settled when all the available lines of evidence have been evaluated and harmonized. Drawing this line at the top of the Fort Union will profoundly affect other areas and other problems, many of which Professor Schuchert appears to have underestimated if not indeed overlooked.

The faith that is in the "floral brethren" is strong! This evidence has been set forth at length on several occasions, but a brief recapitulation may not be without interest. Up to the present time, with one or two minor exceptions, the Fort Union has been everywhere accepted as of Eocene age. It has a very large flora of approximately 500 species. Aside from local stratigraphic and paleontologic considerations, the Eocene age of the Fort Union flora is attested by its affiliation with many European Eocene deposits of definite, acknowledged position, as Ardtun in Mull, Gelinden in Belgium, and Sezanne in the Paris Basin, as well as the Eocene in Greenland and Alaska. This affiliation amounts to many identical and closely related species, as well as identical and related genera. Several Fort Union species are believed to be still living, a condition not known for any earlier American deposit.

The flora of the Lance formation is also a rich one, comprising about 125 forms, some of which, however, are so fragmentary and obscure as to be incapable of more than generic determination. After eliminating the new forms and those that can not be specifically named there are 87 species that are positively identified, all but 15 of which (about 80 per cent.) are found in the Fort Union. It is unmistakably a Fort Union flora, and occurs through the whole vertical range of the Lance formation, some of the most characteristic Fort Union plants being found within four feet of the base of the beds. Of the entire known Lance-Fort Union flora less than 15 species have been reported from Cretaceous beds anywhere, and this number will be reduced instead of enlarged by revision of the floras involved.

Sedimentation was undoubtedly continuous through the Lance and Fort Union formations; in fact, it is impossible to draw any satisfactory line between them. The highest point at which dinosaurs occur is taken as the top of the Lance, but where these remains are absent it has no recognized or recognizable top. If the Cannonball marine member of the Lance formation is Cretaceous then both Lance and Fort Union are Cretaceous, for there is no stopping point short of the top of the Fort Union. Professor Schuchert even holds that there "is here a continuous and unbroken series of deposits from the Pierre and Fox Hills into the top of the Fort Union, and that the reported erosion contacts between the several formations are due to nothing more than changes from marine to brackish and fresh-water deposition, or to irregularities

characteristic of continental sediments, the local breaks not representing a loss of geologic time of any marked historical value."

The plants certainly do not uphold this contention, but they do indicate a very considerable hiatus between the top of the acknowledged marine Cretaceous section and the inauguration of the Lance. The Laramie is not known within this area, but can it be doubted that it was the interval during which in other areas beds of Laramie age were laid down and subsequently removed in whole or in part? That there was an important interval of some kind is also shown by the fact that it was sufficiently long for over 60 per cent. of the marine Cannonball fauna to be derived through modification of the typical Fox Hills fauna. F. H. Knowlton

PROOF OF NON-DISJUNCTION FOR THE FOURTH CHROMOSOME OF DROSOPHILA MELANOGASTER

During the spring and summer of 1920 I secured genetic evidence that strains of *D. melanogaster* haploid for the fourth chromosome had been produced by non-disjunction, and in November cytological verification was obtained. The fact that non-disjunction of the fourth chromosome is known to occur is perhaps the strongest reason for believeing that the aberrations observed by Dr. Little[1] may be the consequences of non-disjunction. The direct evidence presented by Dr. Little by no means proves such to be the case, which is unfortunate, considering the ample means in *D. melanogaster* for checking up this hypothesis by means of other fourth-chromosome mutants (bent, shaven) and especially by direct cytological examination. Probably Dr. Little will include such evidence in his forthcoming detailed report. For the present, his published evidence is in better conformity with the assumption of a less extreme eyeless allelomorph, or of a dominant fourth-chromosome "minus" modifier. On the non-disjunctional view selective reduction of the three fourth chromosomes present is required, but there is no obvious reason why E and e should always go together in the manner assumed. A simple explanation is supplied on the weak-allelomorph view, for Ee is the weak allelomorph and the selective reduction Ee — e is simply *segregation* in the e^w — e compound. *Linkage* supplies the explanation on the modifier view, for the E is then a dominant minus modifier in the fourth chromosome, and Ee — e is simply M^ee — e. As far as can be judged from the short account given, all the observed ratios are in conformity with either of these views. Thus, Dr. Little has not proved by direct and available means that the case is actually one of non-disjunction, nor has he proved it negatively by excluding well-recognized alternative hypotheses which are equally valid and even more in harmony with the facts of the case as stated.

C. B. Bridges

[1] Science, 53: 167.

SURVEYING FROM THE AIR

The article on "Surveying from the Air," December 17, 1920, is a summary of the work of the Coast and Geodetic Survey along the lines of aerial photography, and of necessity does not go into the requisite detail regarding the reasons for making the following statement:

> These experiments proved very conclusively that photographs from the air, using present-day equipment, are of little practical value to the hydrographer.

This statement has been noted by Mr. Willis T. Lee, of the U. S. Geological Survey in Science, February 18, 1921, who cites *Comptes Rendus* Tome 169, October 27, 1919, in which mention is made of experiments near Brest where successful photographs were obtained of the bottom at a maximum depth of 17 meters.

During the experiments at Key West, the results of which were the only ones then known to me, occasional successful photographs of the bottom were obtained in depths of 35 feet and less. No attempt was made to photograph at greater depths. When the conclusion regarding the "practical value" of the photographs was arrived at, all factors re-

garding their use for hydrographic purposes were considered. Obviously, a comparison was made with the present-day methods of hydrographic surveying.

It may be argued that aerial photography is more rapid, because a photograph of more than one square mile is made in a fraction of a second, and a strip 70 miles long and over a mile wide can be photographed in an hour. There are several problems to be overcome by both the aviator and the hydrographer before this can be done. Weather conditions along the sea coast are not as suitable for aerial photography as might be expected. Let us see how the photographs as made by the French would apply to our waters. These photographs were made under the following conditions: Focal plane horizontal; altitude, 2,600 meters; at time of low water; the sun high above the horizon; calm sea. Along the coast of the United States, a calm day is generally hazy, so much so that it is impossible to make photographs from an altitude of even 4,000 feet without special treatment of plates or films. We are aware of recent experiments regarding the penetration of haze, but at the time the Key West experiments were made, little was known of this new process. Further developments may make it possible to penetrate haze at altitudes of 2,600 meters. But disregarding haze, those days that are calm and cloudless are infrequent. It is difficult to obtain data regarding meteorological conditions as affecting aerial photography along the coast, but from available data, it is ventured that about one day a month would fulfill conditions as called for by the French, and that is believed to be an optimistic estimate.

Regarding control for the photographs, very few places along our coast are as ideally fitted for control of aerial protographs as the area chosen near Brest. This locality is dotted with numerous small islets, and ample control could be obtained for each photograph. At Key West, it was necessary to use boats as control points, so that the speed at which an area was covered was limited to the speed of the vessels. There are a few places along our coast where enough land stations would appear for control, but these areas are generally in bays or rivers where water is not clear enough for good photographic work. Buoys or rafts may be used as control points, but the cost and labor of handling them would be excessive. A raft about 10 feet in diameter would be needed in order to be legible on a 1:10,000 scale photograph. The problem of handling a large number of these floating signals would require a good sized vessel and crew.

The uncertainty of results is another factor. The French have solved some of the problems by using the stereoscope, so that the confusion, brought about by vari-colored bottom of uniform depth, is partly eliminated. Some shoals will show clearly, while others close by do not appear in the photograph, probably due to a difference in color or lighting. The photographs will not record all shoals as seen by the aviator. It is often necessary to fly over the same area repeatedly in order to obtain good results.

Unless ideal conditions prevail, the cost of an aerial survey with present-day equipment, will far exceed that of a wire drag survey, and will not give as certain results. We believe that aerial photo-hydrography is of some use in a few limited locations, and there are possibilities of future development, but at the present date, revision work by photographs on land holds forth greater promise, and is one in which more certain results can be obtained.

It may be of interest to quote a sentence from a letter dated January 10, 1921, from Le Directeur du Service Hydrographique addressed to the Director of the Coast and Geodetic Survey, in which the following statement is made regarding aerial photography along the coast of Syria in 1920.

Les circonstances n'ont d'ailleurs pas permis de l'employer systematiquement. (The circumstances do not, however, permit of its systematic use).

A careful analysis of the conclusion reached in the article "Surveying from the Air," especially of the qualifying words "using present-day equipment," and "little practical value,"

will probably derive the result that the statement is not as hastily worded as it was first thought to be.

E. LESTER JONES

SCIENTIFIC BOOKS

Physics of the Air. By W. J. HUMPHREYS, C.E., Ph.D., Professor U. S. Weather Bureau, Philadelphia. Published for the Franklin Institute by J. B. Lippincott Co., 1920.

Professor Humphreys states in his introduction that "it is obvious that an orderly assemblage of all those facts and theories that together might be called the *Physics of the Air,* would be exceedingly helpful to the student of atmospherics."

Of this there can be no doubt, and the author has rendered a great service by thus bringing together and making easily available material that otherwise would have remained scattered through technical magazines, official publications like the *Monthly Weather Review* and journals of organizations like the Royal Meteorological Society.

The volume had its inception in a series of lectures delivered by Dr. Humphreys at the San Diego Aviation School in 1914. These lectures revised and printed from month to month in the *Journal of the Franklin Institute,* 1917, 1918, 1919 and 1920, are now consolidated in one volume.

As late as 1917 our military authorities failed to appreciate the importance of a knowledge of aerography, that is, the structure of the atmosphere. In June of that year a high officer of the Signal Corps, at that time entrusted with aviation, wrote:

> It has frequently happened in the past that men who might otherwise have made good pilots became so alarmed in advance over the subject of "holes in the air" and so impressed with the terrible dangers of aerial navigation, that they never succeeded in gaining the necessary confidence to become good pilots, etc.

This was given as a valid reason for refusing to utilize recent advances in meteorology! And again:

> So little time is available and so great the necessity for extreme haste in preparing aviators for service overseas that there is no opportunity to give more than the elements of meteorology in one or two lectures.

These views are referred to here, simply to show in some measure the amount of official inertia which had to be overcome. After many promising lives had been sacrificed, the need of the fullest knowledge possible was manifest; and before the war ended aerography had come into its own in both army and navy schools of instruction.

Professor Humphreys divides his treatise into four main parts; mechanics and thermodynamics; atmospheric electricity and auroras; atmospheric optics; and factors of climatic control. The author had the great advantage of access to the Weather Bureau Library, and critical readings by his colleagues. Furthermore, the text appeared in type before final publication. The work is unusually free from typographical errors.

There are a few slips, however. On page 49 the symbol for temperature of the isothermal region T might with advantage have been placed in front of the radical, or at least in some way separated more than at present. Again, it would be a gain if instead of saying that the temperature of a black radiator, in this case the earth, was 259° C. absolute, the author had used the more common form 259° A., adding if he thought it necessary, in degrees C. It is desirable in a text-book to avoid confusion, by using consistent notation. The reviewer holds that it is not good form to speak of a given temperature as *259° C. absolute* on one page and on the next page give a diagram expressing the same value in degrees Centigrade, that is, —14° C. One may expect to meet a slip from such loose practise and sure enough it occurs. On pages 75 and 76 it is stated:

> The effective absolute temperature of the earth as a full radiator is approximately 260° C.

Rather a warm condition; but of course the author means that the effective temperature on a certain approximate absolute scale is

260°. There is a scale which might have been advantageously used here, namely the Kelvin-Kilograde scale. True, few are as yet familiar with it; but the colors should always be in advance of the line, not abreast nor yet behind. In an up-to-date scientific book we have the right to expect leadership rather than tolerance.

The airman has got to forget the unscientific, arbitrary scales of his fathers; and stop using inches, minus signs, etc. His range of temperature is from summer day surface values to winter sub-polar readings near the stratosphere; and old-fashioned methods are inadequate.

Pressures are generally given in this book in millimeters of mercury with occasional lapses into inches. In a treatise dated 1920, one might look for pressure values throughout in units of force, that is, dynes or kilodynes per square centimeter.

In the chapter on "Atmospheric Circulation" which is well put, and more clearly explains the mechanics of deflection than most other text-books, it is demonstrated that in the case of a wind with a velocity of 22 meters per second, there will be a modification of velocity, depending upon whether the wind is blowing east or west; that is, a given mass weighs less going east than going west. A note might have been added giving results of recent gravity determinations at sea on fast-moving (22-knot) destroyers (25-mile-per-hour vessels); in which it was definitely ascertained that the barometric pressure changed 0.1 kilobar (0.075 mm.) when the course was reversed. Going east with the earth the centripetal force is greater than when steaming west. All this is of importance in connection with fast-moving airships.[1]

The discussion of change of velocity with latitude, deflective effect of the earth's rotation, relative values of centrifugal and rotational components, and gradient winds, is thorough and well expressed. Of course, the explanation of friction acting as the effective damping factor against high rotational winds is no longer tenable; and there is not sufficient emphasis laid on the fact that the high rotative values are hypothetical, not real so far as mobile air is involved.

Chapter XI., on "Winds Adverse to Aviation," explains the so-called "holes in the air," "bumps," "dunts," etc. There is not a mathematical symbol in the whole chapter. The different phenomena are explained in straightforward, simple language. However, there is much yet to be learned in connection with favorable and adverse conditions; and we await some Maury who will do with the logs of airships what the old Commodore did with the logs of the clippers of his day.

Chapter XIV. contains many photographs of cloud forms, but neither here nor in the first chapter where many instruments are given, is mention made of a nephoscope. Fair credit for cloud work done at Blue Hill Observatory is not given; nor is mention made of Professor Bigelow's International Cloud Report.

Chapter XV., on "The Thunderstorm" has 105 pages, and yet is not included in Part II., dealing with Atmospheric Electricity and Auroras, which has only 18 pages.

Part III., on "Atmospheric Optics," has 129 pages and is based largely on the well-known Pernter-Exner "Meteorologische Optik" and Mascart's "Traité d'Optique."

Part IV., 74 pages, deals with factors of climatic control, that is, in the author's words, a discussion of the physics of climate and not of its geographic distribution. The chief factors considered are latitude, brightness of the moon and planets, solar constant, solar distance, obliquity of ecliptic, perihelion phase, extent and composition of the atmosphere, vulcanism, sun spots, land elevation, land and water distribution, atmospheric circulation, ocean circulation, and surface covering.

Elaborate tables of gradient wind velocities are given in the appendix. We notice a few minor typographical errors. On page 136, latitude 10°, the change of direction is 2°.61 not 261, and the heading needs revising on page 162, m.m. should be mm.; on page 221, figure 31 should be 32; and on page 227, figure

[1] See SCIENCE, February 6, 1920; also January 9, 1920.

57, the lengend should give the elevation of the station.
ALEXANDER McADIE

REPORT OF THE COMMITTEE ON NOMENCLATURE OF THE BOTANICAL SOCIETY OF AMERICA

At the Baltimore meeting of the Botanical Society of America (1918), the Committee on Generic Types presented a set of rules for fixing the types of genera. The report was published in SCIENCE (49: 333–336. 1919). At the same meeting the committee was enlarged to nine members and made a standing committee on botanical nomenclature, with authority to prepare a code of nomenclature. The standing committee consists of LeRoy Abrams, N. L. Britton, E. A. Burtt, A. W. Evans, J. M. Greenman, A. S. Hitchcock, M. A. Howe, C. L. Shear and Witmer Stone. The actual work of elaborating a code was done chiefly by a subcommittee consisting of J. C. Arthur, J. H. Barnhart, R. S. Breed, N. L. Britton, O. F. Cook, F. V. Coville, A. W. Evans, B. Fink, A. S. Hitchcock, M. A. Howe, F. H. Knowlton, P. L. Ricker, C. L. Shear and H. C. Skeels. The following code was presented by the committee:

A TYPE-BASIS CODE OF BOTANICAL NOMENCLATURE

PRINCIPLES

1. The primary object of formal nomenclature in systematic biology is to secure stability, uniformity, and convenience in the designation of plants and animals.

2. Botanical nomenclature is treated as beginning with the general application of binomial names to plants (Linnæus' "Species Plantarum," 1753).

3. Priority of publication is a fundamental principle of botanical nomenclature. Two groups of the same category can not bear the same name.

Note a.—This principle applies primarily to genera and species.

Note b.—Previous use of a name in zoology does not preclude its use in botany; but the proposal of such a name should be avoided.

4. The application of names is determined by means of nomenclatural types.

Note.—A generic name is always so applied as to include its type species; a specific name is always so applied as to include its type specimen.

Rules and Recommendations

Section 1. Publication of Names

Article 1. A specific name is published when it has been printed and distributed with a description, or with a reference to a previously published description.

Note.—A recognizable figure may be the equivalent of a description in the literature of paleobotany and diatoms.

(*a*) In the transfer of a species from one genus to another, the original specific name is retained, unless the resulting binomial has been previously published.

Recommendations: Botanists will do well, in publishing:

1. In describing parasitic fungi to indicate the host and to designate the name of the host by its scientific Latin name.

2. To give the etymology of all new generic names.

Article 2. A generic name is published when it has been printed and distributed

(*a*) With a generic or specific description (or a recognizable figure, see Art. 1, note) and a binomial specific name,

(*b*) With a generic and specific name and the citation of a previously published description,

(*c*) With a definite reference to at least one previously published binomial.

Note a.—A name is not published by its citation in synonymy, nor by incidental mention. Such a name may be taken up but not to replace one already properly published.

Note b.—Of names published in the same work and at the same time, those having precedence of position are to be regarded as having priority.

Recommendation: Botanists will do well, in publishing, to give the etymology of specific names when their meaning is not obvious.

Section 2. Application of Names

Article 3. The nomenclatural type of a species is the specimen or the most important of the specimens upon which its original published description was based.

(*a*) If only one specimen is cited, that is the type.

(*b*) If one specimen is designated as the type, that specimen shall be so accepted, unless an error can be demonstrated.

(*c*) A species transferred without change of name from one genus to another retains the original type even though the description under the new genus was drawn from a different species.

(*d*) The publication of a new specific name as an avowed substitute for an earlier one does not change the type of the species.

(*e*) When more than one specimen was originally cited and no type was designated the type should be selected in accordance with the following :

1. The type specimen interprets the description and fixes the application of the name, hence, primarily the description controls the selection of the type.

2. The type may be indicated by the specific name, this being sometimes derived from the collector, locality, or host.

3. If one specimen is figured in connection with the original description this may usually be regarded as the type.

4. Specimens that are mentioned by the author as being exceptional or unusual, or those which definitely disagree with the description (provided others agree) may usually be excluded from consideration in selecting the type.

5. An examination of the actual sheets of specimens studied by the author may aid in determining or selecting the type. He may have written the name or left notes or drawings upon one of the sheets.

Note.—Specimens known to have been received by the author subsequent to the study resulting in the original publication should be excluded from consideration.

6. If an author, in publishing a new species, gives a description of his own, this takes precedence over synonymy or cited descriptions, in determining the type specimen.

Article 4. The nomenclatural type species of a genus is the species or one of the species included when the genus was originally published.

(*a*) If a genus includes but one species when originally published this species is the type.

(*b*) When more than one species is included in the original publication of the genus, the type is determined by the following rules: (These rules are Articles 3 to 6 of the Report of the Committee on Generic Types published in SCIENCE, N. S., 49: 334–336, 1919.)

Recommendations: In the future it is recommended that authors of generic names definitely designate type species; and that in the selection of types of genera previously published, but of which the type would not be indicated by the preceding rules, the following points be taken into consideration. (This includes Article 7, *a* to *g*, of the Report on Generic Types published in SCIENCE, *loc. cit.*).

Section 3. Rejection of Names

Article 5. A name is rejected

(*a*) When preoccupied (homonym).

1. A specific name is a homonym when it has been published for another species under the same generic name.

2. A generic name is a homonym when previously published for another genus.

3. Similar names are to be treated as homonyms only when they are mere variations in the spelling of the same word; or in the case of specific names, when they differ only in adjective or genitive termination.

(*b*) When there is an older valid name based on another member of the same group (metonym).

(*c*) When there is an older valid name based on the same type (typonym).

(*d*) When it has not been effectively pub-

lished according to the provisions of Section 1 of these rules (hyponym).

Article 6. There may be exceptions to the application of the principles and rules of this code in cases where a rigid application would lead to great confusion. Such exceptions become valid when approved by the Nomenclature Commission.

Nomenclature Commission

A code of nomenclature should secure uniformity, definiteness and stability in the application of names. If proposed rules result in the change of well-established names of economic plants botanists will hesitate to apply them uniformly. All contingencies can not be foreseen and experience has shown that the rigid application of any set of rules results in a few cases of greatly confused nomenclature. The committee has recognized this and hence has introduced an article permitting exceptions. The committee also recognized that to secure uniformity and definiteness the exceptions should in some way be validated. The most convenient and practical validation would be through a permanent judicial body created for the purpose. As the proposed code invites international support, the judicial body should be an international commission. The committee felt that much could be done to pave the way for future international action by appointing a national commission and therefore tentatively submitted a plan for the creation of such a body. This temporary Nomenclature Commission was to consist of nine members, one nominated by the Society of American Bacteriologists, one nominated by the American Phytopathological Society, three elected by the Botanical Society of America, and four elected by the Committee on Nomenclature of the Botanical Society. The details concerning elections and reappointments are here omitted.

The chairman will add that since a subsequent international commission would feel restricted by the decisions of a national body, it might be well to have these decisions take the form of recommendations, the commission meantime perfecting rules and formulating methods of procedure. International rules of nomenclature, including rules for the retroactive fixation of generic types and including a provision for exceptions, together with an International Commission to validate names (generic types and nomina conservanda) would go far toward giving to botany a stable and uniform nomenclature.

A. S. Hitchcock,
Chairman

Bureau of Plant Industry,
Washington, D. C.

SPECIAL ARTICLES

A FISH, WITH A LUMINOUS ORGAN, DESIGNED FOR THE GROWTH OF LUMINOUS BACTERIA

It has been known for many years that luminous bacteria are abundant in the sea and will grow readily upon dead fish or other marine organisms. It has been reported that at times luminous bacteria may infect living forms, such as sand fleas. A malady is produced, which is finally fatal but which, during its course, causes the animal to luminesce like a true luminous form.[1] Pierantoni[2] has suggested that the light of many luminous organisms is due to symbiotic bacteria living in the cells of the luminous organisms. He claims to have grown the bacteria artificially in the case of certain squid.

While I feel convinced that this is not the case in all luminous animals I have recently had an opportunity[3] of studying two forms which do appear to utilize bacterial light. These are the marine fishes, *Photoplepharon* and *Anomalops,* found in the Banda Islands of the Dutch East Indian Archipelago. They have been known to be luminous since 1897, but the organ was first studied histologically by Steche[4] and found to be made up of a series of columnar gland tubes, a number of which

[1] Giard and Billet, *C. R. Soc. Biol.,* I., 593, 1889.

[2] Scientia, XXIII., 43, 1918.

[3] A study made under the auspices of the Department of Marine Biology, Carnegie Institution of Washington.

[4] *Zeit. Wiss. Zool.,* XCII., 349, 1909.

unite to a reservoir which opens to the sea water by a pore. The pores are quite regularly arranged over the outer surface of the organ from which the light emerges.

Despite the general appearance of an organ of external secretion, no luminous material is excreted to the sea water by the living fish. This rather unusual fact has, I believe, its meaning. If the organ is tested in sea water and examined under the microscope, innumerable motile rod-shaped bacteria, sometimes forming spirilla-like chains, can be seen. Smears of the organ, which I obtained in Banda, have been very kindly stained for me by Professor Dahlgren, of Princeton University, and show the bacteria nicely.

In chemical respects an emulsion of the organ behaves just as an emulsion of luminous bacteria and differs in one or another way from extracts of other luminous animals. These various characteristics may be summarized as follows:

1. The light organ is extraordinarily well supplied with blood vessels and the emulsion fully as sensitive to lack of oxygen as are luminous bacteria. Light ceases very quickly in absence of oxygen.

2. If dried, the organ will give only a faint light when again moistened with water. This is characteristic of luminous bacteria. The luminous organs of most other forms can be dried without much loss of photogenic power.

3. Luciferin and luciferase can not be demonstrated.

4. The light is extinguished *without a preliminary flash* by fresh water and other cytolytic (bacteriolytic) agents.

5. Sodium fluoride of 1 to 0.5 per cent. concentration extinguishes readily the light of an emulsion of the gland.

6. Potassium cyanide has an inhibitive effect on light production in about the same concentration as with luminous bacteria.

To these observations must be added the very suggestive fact that the light of *Photoplepharon* and *Anomalops* continues night and day without ceasing and quite independently of stimulation. This is a characteristic of luminous bacteria and fungi alone among organisms, and very strongly suggests that the light is actually due to symbiotic luminous bacteria. The organ becomes, then, an incubator for the growth and nourishment of these forms and we may perhaps look upon the pores mentioned above as a means of exit for dead bacteria. Otherwise their existance would be inexplicable in an organ which certainly does not produce an external secretion.

Actual proof that the bacteria found in the organ are luminous can only come when these are grown artificially. My attempts in this direction have failed. Good growths of bacteria were obtained on pepton-agar but they produced no light. One might expect that a symbiotic form would require rather definite food materials to produce light and it is, perhaps, not surprising that culture experiments have failed. We have Giard and Billet's experience with the form infecting sand fleas. This could be grown artificially but only produced light when infecting the sand fleas themselves. Certainly, the ocular and chemical evidence, if not the cultural evidence, supports the view that the light of these living fish is bacterial in origin. A complete account of the fish will appear shortly in the Carnegie Institution Publications.

E. NEWTON HARVEY

PRINCETON UNIVERSITY,
March 1, 1921

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SECTION L—HISTORY OF SCIENCE SESSIONS

THE growing and widespread interest in the history of science, in this country, was very evident during the Convocation Week (December 27–January 1), when two learned national organizations held meetings in Washington, D. C., and Chicago. Each of these organizations held sessions upon the history of science.

During the same week in 1919, The American Historical Association inaugurated the movement by holding at its Cleveland meeting, a most interesting and successful conference.[1] This same asso-

[1] SCIENCE, N. S., Vol. LI., pp. 193–194, February 20, 1920.

ciation again held a conference in the History of Science at its Washington meeting.[2]

This year (1920) a similar movement was instituted by the scientists, and the president of the American Association for the Advancement of Science, through the council, appointed an organizing committee consisting of the following scholars:

Dr. William W. Welch, Johns Hopkins University,
Dr. A. P. Carman, University of Illinois,
Dr. Felix Neumann, Washington, D. C.
Dr. George Sarton, Carnegie Institution,
Dr. William A. Locy, temporary chairman, Northwestern University,
Dr. Henry G. Gale, University of Chicago,
Dr. C. Judson Herrick, University of Chicago,
Frederick E. Brasch, secretary, John Crerar Library, Chicago.

Through the efforts of this committee the policy of the History of Science section was established. The principal fact to be noted, however, in conjunction with this policy, was the adoption of a plan whereby the function of the program committee was such as to offer the utmost freedom in cooperating and coordinating with existing sections in the American Association. In view of the unique position of the History of Science section relative to the older sections, the relation is such that conflicts of interest are great. Therefore, in order to advance the work and interest of the History of Science, and, at the same time, minimize this conflict—also to meet the growing interest of a large number of scholars both in the technic and history of their respective sciences, the following policy has been approved:

> The program shall be flexible, so that such papers as are technical (example—mathematics) in historical treatment be given in sections where they will be most appreciated, and the more general historical papers be given in the special section (History of Science). It is also the opinion of the committee, that papers for this section shall be given by invitation.

This plan was thought most feasible, and has subsequently proven a success, as was evident at the first conference during American Association for the Advancement of Science week.

Consequently, the first joint session was held with Section A (American Mathematical Society and the Mathematical Association of America). Papers were presented by well known scholars in the History of Mathematics. The first was by Dr. Louis C. Karpinski, of the University of Michigan, who presented a most interesting topic, namely: "Geometrical development of analytical ideas."

The purpose of this paper is to show that many of the fundamental concepts of analysis had their progenitors in ideas developed by the Orientals, the Greeks, the Arabs, and the Europeans, to the time of Newton, along geometrical lines. The algebraical problems of the first degree equation in one unknown, the quadratic and the cubic, were all early solved by geometrical means; many of the dominating "motif" problems and theories of geometry lead directly to the quadratic and the cubic. The problem of the pentagon, of the trisection of the angle, of the duplication of the cube, of the conic sections of the regular polygons of seven and nine sides, and even of the squaring of the circle, all contributed to the geometrical development of analytical ideas.

With the Arabs first came the quite complete appreciation of the algebraical and geometrical correspondences, which culminated, of course, in the work of Descartes, with whom modern mathematics begins.

The second paper was given by Dr. David Eugene Smith, of Columbia University—"The earliest mathematical work printed in the New World."[3]

It was supposedly known that the earliest mathematical work printed in America was that by Isaac Greenwood, first Hollis professor of mathematics and natural philosophy at Harvard College (1727–1738). It was printed in Boston, 1729. However, it thus appears through Dr. Smith's efforts that the first mathematical book printed in America was one printed in Mexico City, 1556. Of this work, known as the "Sumario Compendiso," there remain perhaps only four copies. The book consists of one hundred and three folios, generally numbered. The author, Juan Diez, undertook the work primarily for the purpose of assisting those who were engaged in buying of gold and silver from Mexico, for the moneyed class of Spain. The principal text consists of tables relating to the purchase price of various grades of silver, and of gold, and to monetary affairs of various kinds. The mathematical text consists of twenty-four pages of problems of arithmetic and algebra. Aside from the great historical importance and rarity this book possesses, it also has an interesting place in the early history of education in America.

In the second joint meeting the third paper was presented by Dr. Florian Cajori, of the University of California. His topic, "The evolution of algebraic notations," was illustrated by slides. Due to the extremely technical character of this topic, which involved so many symbols and signs, and the tracing of the evolutionary character of the notation by a long and painstaking detail study, it is not possible to give an adequate ab-

[2] SCIENCE, N. S., Vol. LIII., p. 122, February 4, 1921.

[3] A full account of this paper is to be found in *The American Mathematical Monthly*, 28: 10–15, January, 1921.

stract here. However, Dr. Cajori pointed out that there was danger in having both too few symbols for notations, and also too many. While mathematics is essentially a science of logic by symbols, yet there is a justification for conservative use of such notations.

The most notable fact observed at these joint meetings was the keen interest shown for historical papers, which may be an innovation to the mathematicians and a matter to be considered for future meetings. It only proves too conclusively the value and importance historical papers have within the technical group. Not alone has the cultural phase been emphasized, but there is also the psychological phase. The arduous task of listening to a long series of extremely technical papers is enlivened by a reaction given by some historian's account of a period, a biography or event in mathematical progress.

Wednesday afternoon at 2 o'clock the first single session of the History of Science section took place. After a few brief introductory remarks, concerning the purpose of the History of Science section and a report of the organizing committee, Dr. William A. Locy, temporary chairman, introduced the first speaker, Dr. James H. Breasted, of the Haskels Oriental Museum, University of Chicago, who spoke at length upon "The state of research in early Egyptian science." Dr. Breasted's research has enabled him to point out the large possibilities for greater investigation in the practical unknown Egyptian sciences. His remarks gave one to understand that the future historian of science will have to labor long and hard in the fields from astronomy to medicine and engineering. The question is, where to find the student prepared for this practically unexplored field.

Dr. Walter Libby, professor of the history of medicine, University of Pittsburgh, spoke upon "John Hunter as a forerunner of Darwin." Too little seems to be known of John Hunter (1728–1793) from the point of view of a biologist. A man self-educated late in life, he rapidly rose to a position in the medical sciences, and became an authority in research into anatomical and physiological problems.

The next paper was "Sir William Osler's last historical discovery," by Mr. J. Christian Bay, medical librarian, John Crerar Library. Osler's last literary investigation was probably one of the most interesting and fascinating pieces of historical discovery of recent date in the History of Science. The place and labors of the mystic philosopher, Nicholas of Cusa (1401–1464) is not very well understood in the history of scientific thought. Mr. Bay presented phases of Osler's discovery that were practically unknown; that Cusa possessed some understanding of static electricity, that he performed experiments, and in general was far in advance in ideas bearing upon magnetism. It would thus appear that Cusa preceded William Gilbert (1540–1603) by about 150 years. At the close Mr. Bay paid a beautiful tribute to Sir William Osler, as a man, scholar and scientist.

Owing to the interesting and long discussions provoked by the preceding speakers, the time was growing short, therefore, Dr. Locy's paper was given by title only—"The earliest printed book on natural history—1475–1500."

Dr. Frank B. Dains, of the University of Kansas, presented a paper entitled "Applied chemistry in prehistoric and classical times." The work of the early people in the use of bronze, iron and other metal, showed to some extent the possibility of metallurgy being understood. Applied chemistry of the prehistoric people and in classical times is so little known that the problems of research in the history of science offer immense results. We have very little in the form of written records, but buried treasures as they are brought up by the excavations of archeologists are probably better than the records themselves. Dr. Dains pointed out, as did Dr. Breasted, that the whole history of science before Greek civilization is yet too far in the realm of the unknown.

The last paper of this group was "Early surveying and astronomical instruments in America," given by Dr. Florian Cajori, who, with the aid of illustrated views, showed a remarkably interesting collection of instruments imported, and also constructed in this country. The most complete and well constructed coast and geodetic survey instruments made for the early survey in the United States were those of Ferdinand R. Hassler. A Swiss surveyor of excellent training gave to this country his best talent and consequently laid a foundation for future work that has not been revised or repeated. Dr. Cajori brought out many interesting facts and views in relation to Hassler that were entirely new to the history of science in America.

Thursday morning was devoted to the remaining part of the single session of the History of Science section. The papers presented at this time were of much longer duration. Dr. W. Carl Rufus, of the Detroit Observatory, University of Michigan,

prepared a splendid and also unique outline of the "Proposed periods in the history of astronomy in America." Dr. Rufus showed clearly by six successive steps, or periods, how each developed and expanded into a "two-dimensional form," or system.

Beginning with the introductory period (1490–1600) he stated how astronomy played its part in early navigation and explorations. Following the colonial period (1600–1780) was the beginning of observational astronomy, dominated by John Winthrop and David Rittenhouse. Next was the apparent stationary period (1780–1830), the beginning of mathematical astronomy, established by Nathaniel Bowditch and Benjamin Peirce. Following this came the popular period (1830–1860), the beginning of practical astronomy and the rapid rise of college observatories. New astronomy (1860–1890) was the beginning of astrophysics—the study of the chemical and physical properties of the star light. The last is the contemporary or correlation period (1890–), the beginning of quantitative astrophysics.

In each of these six successive periods of course there is the overlapping in time—there is no clear demarcation setting off one period from another. Such an outline as presented by Dr. Rufus should form the basis of the history of the physical sciences in America. This paper is to appear in print in the course of a few months.

The last paper before the History of Science section was that by Dr. H. A. Bumstead, of the National Research Council and of Yale University. Dr. Bumstead presented the paper "The history of physics," which was one of a series of lectures on the History of Science given before the Yale faculty and students.

The history of experimental physics from the time of Newton to the present was given so ably and charmingly that one might almost say a standard of scholarly presentation of a scientific topic had been reached. Fortunately this paper also is to appear in one of the early numbers of the *Scientific Monthly,* and later to appear in book form. This marked the last public address of Dr. Bumstead, for on the followng day, en route to Washington, he died. The richness of Dr. Bumstead's singularly attractive personality, and the depth of his scholarship and culture have left an indelible mark on all those who have ever come in contact with him.

During the Wednesday session the election for officers of the section was held—and the following were accordingly elected:

For Vice-president: Dr. William A. Locy, Northwestern University.

For Sectional Committee: Dr. Florian Cajori, University of California; Dr. George Sarton, Carnegie Institution; Dr. Walter Libby, University of Pittsburgh; Dr. Louis C. Karpinski, University of Michigan.

For Secretary: Frederick E. Brasch, John Crerar Library, Chicago.

This holding of two conferences by two different organizations, marks the beginning of a new phase of scientific learning and scholarship in America.

In Europe much has been accomplished in the advancement of the History of Science studies, especially so in England. Oxford and Cambridge universities and University of London have recognized the cultural value and have established facilities for research work. Also, independent sections for the History of Science have been organized by the "Versammlung Deutscher Naturforscher und Aerzte," and by the "Società Italiana per il Progresso delle Scienze." The activity of the Italian historians of science is evidenced by the new publication—"Archivio di Storia della Scienza," edited by Aldo Mieli; besides other historical publications that are appearing. And it is to be desired similar publications be encouraged and supported in this country. Therefore, it is to be hoped that through cooperation and coordination the History of Science movement, thus fostered and encouraged by the American Historical Association and the American Association for the Advancement of Science, can likewise aid in this "New Humanism."

Frederick E. Brasch,
Secretary

THE OPTICAL SOCIETY OF AMERICA

The Optical Society of America was organized in 1916. As stated in its constitution, "It is the aim and purpose of this society to increase and diffuse the knowledge of optics, to promote the mutual interests of investigators of optical problems, of designers, manufacturers and users of optical instruments and apparatus of all kinds and to encourage cooperation among them." While the society pays especial attention to "applied" optics and, on this account, covers a field not previously covered, it is not to be regarded as a technological society in contradistinction to a society devoted to "pure" science. The aim of the society is to cover the field of optics, including "pure" optics as well as "optical engineering."

It solicits the support and membership of all persons "interested in optics" whatever their particular interest may be. The actual present scope of the society's activities will be best indicated by the contents of its journal and the program of its latest meeting given below.

The present membership of the society is about two hundred and twenty and is increasing rapidly. The officers for 1921 are:

President, J. P. C. Southall, Columbia University, New York City.

Vice-president, C. E. Mendenhall, University of Wisconsin, Madison, Wis.

Secretary, Irwin G. Priest, Bureau of Standards, Washington, D. C.

Treasurer, Adolph Lomb, Bausch & Lomb Optical Co., Rochester, N. Y.

Editor, Paul D. Foote, Bureau of Standards, Washington, D. C.

MEMBERS OF THE COUNCIL IN ADDITION TO ABOVE OFFICERS

Past-president (1920), F. K. Richtmyer, Cornell University, Ithaca, N. Y.

Elected Members at Large 1921: P. G. Nutting, Westinghouse Research Laboratory, East Pittsburgh, Pa.; C. E. K. Mees, Eastman Research Laboratory, Rochester, N. Y.; L. A. Jones, Eastman Research Laboratory, Rochester, N. Y.; W. E. Forsythe, Nela Research Laboratory, Nela Park, Cleveland, Ohio.

Recent meetings were held in New York February 26-27, 1920, and Chicago, December 27-29, 1920. The program of the Chicago meeting follows:

Courses in optics and optometry in Columbia University: JAMES P. C. SOUTHALL, Columbia University.

Thermal expansion of wires used in glass seals: C. G. PETERS and C. H. CRAGOE, Bureau of Standards.

Refractive index of glass through the annealing range: C. G. PETERS and C. H. CRAGOE, Bureau of Standards.

Notes on the theory of photographic spectrophotometers: E. D. TILLYER, American Optical Company.

A new ocular micrometer: HERMANN KELLNER, Bausch & Lomb Optical Co.

Presentation and Discussion of the Reports of the Committees on Nomenclature and Standards: P. G. NUTTING, General Chairman.

1. Colorimetry, L. T. Troland.
2. Lenses and Optical Instruments, J. P. C. Southall.
3. Optical Glasses, George W. Morey.
4. Photographic Materials, W. F. Meggers.
5. Photometry and Illumination, E. C. Crittenden.
6. Polarimetry, F. E. Wright.
7. Projection, L. A. Jones.
8. Pyrometry, W. E. Forsythe.
9. Reflectometry, A. H. Taylor.
10. Refractometry, C. A. Skinner.
11. Spectacle Lenses, E. D. Tillyer.
12. Spectrophotometry, A. H. Pfund.
13. Spectroradiometry, W. W. Coblentz.
14. Visual Sensitometry, Prentice Reeves.
15. Wave Lengths, W. F. Meggers.

(About half of the above reports were presented before the general meeting by title only.)

A comparison of monochromatic screens for optical pyrometry: W. E. FORSYTHE, Nela Research Laboratory.

An improved form of Pickering polarimeter for gloss measurements (by the polarization method): L. R. INGERSOLL, University of Wisconsin.

An unfamiliar anomaly of vision and its relation to certain optical instruments: W. B. RAYTON, Bausch & Lomb Optical Co.

Double refraction of glass tubing as indicating the strains present: A. Q. TOOL and C. G. EICHLIN, Bureau of Standards.

Monocular and binocular perception of contrast and brightness: PRENTICE REEVES, Eastman Kodak Company.

Systems of color standards: A. AMES, JR., Dartmouth College.

A new study of the leucoscope and its application to pyrometry. (Extension of work reported at N. Y., February, 1920): IRWIN G. PRIEST, Bureau of Standards.

Address of the retiring president of the Optical Society of America. *Some outstanding problems of physiological optics:* F. K. RICHTMYER, Cornell University.

Atmospheric corrections for the Harcourt Standard Pentane lamp: E. B. ROSA, E. C. CRITTENDEN, A. H. TAYLOR, Bureau of Standards.

Some major problems in photometry: E. C. CRITTENDEN and J. F. SKOGLAND, Bureau of Standards.

Comparative tests as to the accuracy of various methods for precision measurements of focal lengths (by title): W. O. LYTLE and A. K. BENNETT, Bureau of Standards.

The diffusion of light in a searchlight beam (by title): ENOCH KARRER and U. M. SMITH, Bureau of Standards.

Further results on the heat of absorption of glass: A. Q. TOOL and C. G. EICHLIN, Bureau of Standards.

A recent new system of formulæ for tracing rays through a combination of lenses: JAMES P. C. SOUTHALL, Columbia University.

Notes on lens computation: HERMANN KELLNER, Bausch & Lomb Optical Co.

A new astronomical lens: FRANK E. ROSS, Eastman Kodak Company.

Note on the extended theory of the sectored disk used in photometry (by title): ENOCH KARRER, Bureau of Standards.

Measurements of aberrations of the eye: C. A. PROCTOR and A. AMES, JR., Dartmouth College.

Characteristics of retinal image: A. AMES, JR., and C. A. PROCTOR, Dartmouth College.

Some notes on condenser correction in optical projection (by title): G. W. MOFFIT, Eastman Kodak Company.

The use of the Ulbricht sphere in measuring reflec-

tion and transmission factors (by title): ENOCH KARRER, Bureau of Standards
A comparison of retinoscopic, subjective and finally acceptable ocular corrections: CHARLES SHEARD, American Optical Company.
A new method of joining glass: C. O. FAIRCHILD, Bureau of Standards.
The effect of variations in intensity of illumination of functions of importance to the working eye (by title): C. E. FERREE and G. RAND, Bryn Mawr College.
Optical determination of stress in transparent materials: A. L. KIMBALL, General Electric Co.

The following papers were contributed by the Optical Society to a joint meeting with the American Physical Society:

Photographic reproduction of tone: L. A. JONES, Eastman Kodak Company.
The spectral distribution of energy required to evoke the gray sensation: IRWIN G. PRIEST, Bureau of Standards.
The propagation of light in rotating systems: L. SILBERSTEIN, Eastman Kodak Company.

The next meeting will be held in Rochester in October, 1921. Because of the optical industries centered in and near Rochester and the proximity to universities in which much attention is given to optics, it is expected that this will be a particularly notable and profitable meeting. The program will be announced about the end of September. Titles may be submitted to the secretary at any time prior to that date.

An important feature of the society's work lies in its continuous Committee on Standards and Nomenclature. This committee includes a number of subcommittees dealing with specific fields, such as: colorimetry, photographic materials, photometry, polarimetry, projection, pyrometry, reflectometry, refractometry, spectacle lenses, spectrophotometry, spectroradiometry, visual refraction, visual sensitometry and wave-lengths. Through the work of these committees the society is gradually bringing into being a body of standard data and standard nomenclature which will contribute materially to the progress of science.

The first number of the *Journal of the Optical Society* was issued under date of January, 1917. The publication was designated as "bi-monthly," but during the war the dates of issue were necessarily irregular and the publication discontinuous. Librarians and others will be interested in the following statement of issues. During the calendar years 1917–1919 inclusive there were six separate issues designated as follows:

Vol. I., No. 1, January, 1917.
Vol. I., Nos. 2–3, March-May, 1917.
Vol. I., No. 4, July, 1917.
Vol. I., Nos. 5–6, September-November, 1917.
Vols. II.-III., Nos. 1–2, January,March, 1919.
Vols. II.-III., Nos. 3–6, May-November, 1919.

There were no issues in the calendar year 1918.

Beginning with January, 1920, the size and style of the journal were changed, and it is now issued regularly bi-monthly.

The by-laws state eligibility to membership as follows: "Any person who has, in the opinion of the council, contributed materially to the advancement of optics shall be eligible to regular membership in the society. Any person or corporation interested in optics is eligible to associate membership." Associate members have the same privileges and duties as regular members except that they may not vote nor hold office.

The annual dues are five dollars for both classes of individual members and fifty dollars for corporation members. Dues include subscription to the journal.

Applications for membership should be addressed to Irwin G. Priest, secretary, Optical Society of America, c/o Bureau of Standards, Washington, D. C.

Payment of dues should *not* accompany application. Bill will be sent after action is taken on the application.

Information in regard to the journal may be obtained by addressing Paul D. Foote, editor, *Journal Optical Society of America,* c/o Bureau of Standards, Washington, D. C.

Sample copies of the journal can not be furnished free, but the complete table of contents for 1920 will be mailed free on request

A cordial invitation to become members is extended to all persons who are interested in the purposes and activities of the society.

IRWIN G. PRIEST,
Secretary

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